EGU25-9110
EGU General Assembly 2025


# Spatial modeling of fire ignition in Chile: comparing arson and accidental fires

**Rodrigo Crespo Pérez**[1], Marcos Rodrigues Mimbrero[1], Jorge Félez Bernal[2], Juan de la Riva Fernández[1], Roberto Serrano Notivoli[1], Dhais Peña Angulo[1], Pere Gelabert Vadillo[3], and Luiz Galizia[4]

[1]University of Zaragoza, Department of Geography, Zaragoza, Spain (776412@unizar.es)
[2]University of Concepción, Center of Environmental Sciences EULA-Chile, Concepción, Chile (jfelez@udec.cl)
[3]University of Lérida, ETSEA, Lérida, Spain (perejoan.gelabert@udl.cat)
[4]AXA climate, AXA, Paris, France (luiz.galizia@axaclimate.com)

Fires in Chile are one of the main natural threats to society and the balance of ecosystems. As is common, the cause behind most of them is human action, and their occurrence is linked to numerous climatic, environmental, or accessibility factors. The aim of this study was to predict the daily probability of ignition for all continental Chile, with a spatial resolution of 100 meter, distinguishing between intentional and unintentional fires to study potential disparities in the role of fire drivers. To achieve this, a Random Forest machine learning model was trained and tested using CONAF's ignition data from 2009 to 2019.

A total of 100 model realizations were calibrated by combining randomly stratified samples of fire ignition with spatial variables related to accessibility, anthropogenic presence, infrastructure, and dead fuel moisture content. For each realization, we trained and evaluated a binary classification Random Forest model, aggregating their outcomes and predictions to account for uncertainty. Models were also evaluated in terms of prediction ability and residuals independence.

The results show differences between intentional and unintentional fires in terms of accuracy (0.86 and 0.83, respectively), but also regarding the role of the drivers. Notable differences in variable importance were also observed, with distance to power lines being the most important variable for intentional fires, while the Wildland-Urban Interface (WUI) played a larger role for unintentional fires. While the importance of WUI had been identified in previous studies, the significance of distance to power lines had not been widely considered, despite its potential impact on the accessibility of remote areas with high fuel loads. Interestingly, dead fuel moisture (DFMC) and fuel types were less important in both models, with DFMC showing surprisingly low relevance, contrary to expectations. The ignition probability maps generated displayed similar small-scale spatial patterns, with high ignition probabilities concentrated in central Chile, where most studies have been conducted. The southern and northern regions showed either negligible or low ignition probabilities, mainly due to a lack of fuel. At a local scale, intentional fire models were clearly associated with power lines and road networks, while unintentional fires were more influenced by proximity to buildings. Areas farther from human activity centers showed higher

probabilities for unintentional fires, likely linked to recreational activities.